Texas Precision Agriculture

The Texas A&M University System – Agriculture Program

Annual Reports - 2000

Principal Investigator: G. J. Michels, Jr.
Texas Agricultural Experiment Station,
2301 Experiment Station Road, Bushland, TX 79012
E-mail: asychis@aol.com

Cooperators: C. M. Rush, G. Piccinni. D. A. Owins

Primary Research Location: Bushland, TX

Project Title:

Factors Impacting Development of a Remote Sensing Dependent Site-Specific Irrigation/Chemigation System

Reporting Period: FY 2000

Objectives:

1) Evaluate the efficacy of infrared thermometers (IRT) and multi-spectral radiometers for detection and differentiation of biotic and abiotic stresses
2) Generate maps of specific pest infestations over time using remote sensing, GPS, and GIS technology for integration into a site-specific irrigation/chemigation system,
3) Identify interactions between biotic and abiotic stresses that could impact accuracy of maps and subsequent recommendations to producers

A. **Summary of Progress:**

Completed evaluation of infrared thermometers for detection of greenbug stress on winter wheat, and published the results (see publications below).

Expanded multispectral radiometer research on detection of greenbug infestations on winter wheat. Research is ongoing with greenhouse experiments underway, and we are ready to go to the field to do ground-truthing in the spring of 2001. A graduate student has been recruited who is responsible for this research.

Completed third year of research on the interactions of sorghum plant populations, irrigation regimes key to PET levels and greenbug infestations 3 (see figures 1 through 3). The results have been very good, especially with the inclusion of the third year's data. The study has been concluded and a journal article is in preparation (see below).

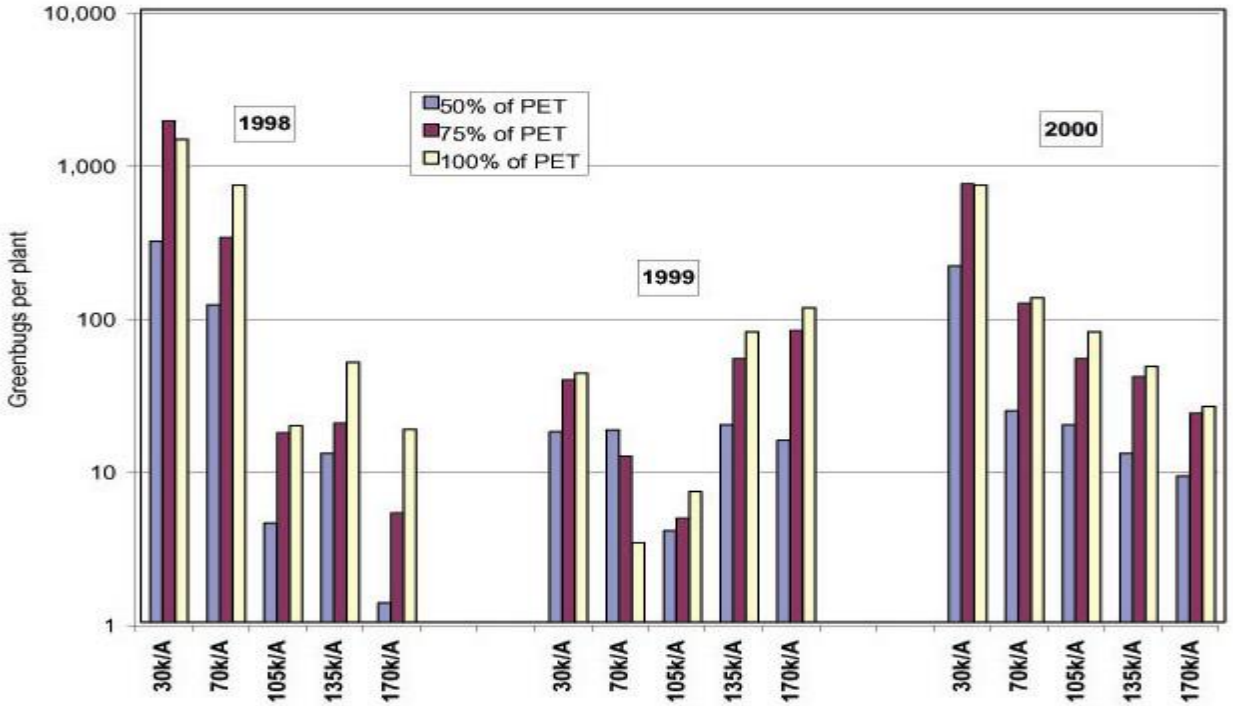

FIGURE 1.

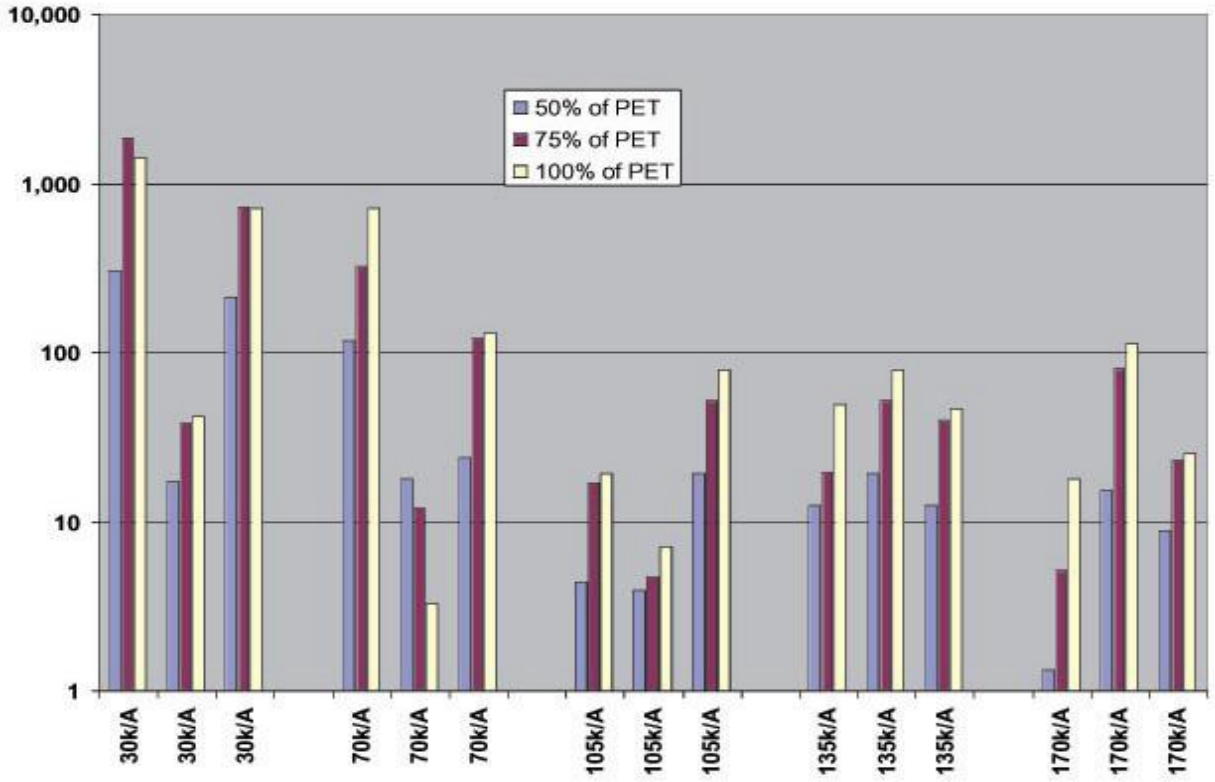

FIGURE 2.

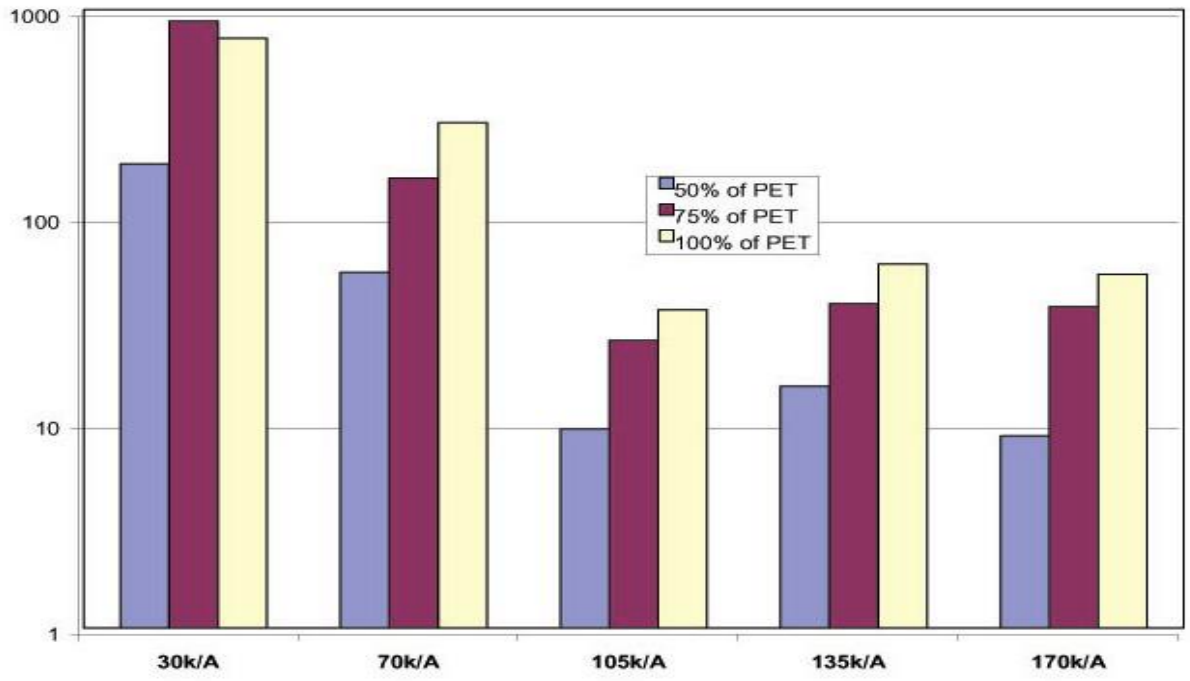

FIGURE 3.

We have completed the fourth years' research on Western corn rootworm seasonal population trends in the Texas Panhandle. The thrust of the research is to develop a predictive model for rootworm egg hatch and adult emergence in relationship to the weather data that can be collected on site by our NPPET network.

B. Education / technology transfer:

The results, current experiments, and plans for Precision Agriculture were shown during group tours and meetings. Examples include presentations at the Bushland Wheat Field Day, a tour of graduate students taking an advanced agronomy course under Dr. Clay Robinson at WTAMU and a briefing for State Representative Mac Thornberry.

Debi Owings attended a one-week workshop in San Antonio on Arc View in October 2000.

C. Milestones achieved:

The completion of the IRT research yielded good, although not completely positive results. However, the results did permit us to state that IRT's should not be looked at as precision agriculture tools in and of themselves for insect detection. The research spurred interest in multi- and now hyperspectral radiometers as perhaps better means of remote sensing agronomic pests.

We area very happy with the results of the sorghum research on he impact plant density and irrigation regimes have on greenbug infestations. We believe this research as been key to pointing out that precision agriculture techniques can impact pest populations, and producers need to be aware that changing agronomic techniques can

have unexpected results. Our research also confirmed that, at least in the Texas High Plains, two years of field data is definitely marginal for conclusions. If we had stopped this research in 1999 instead of carrying it out through 2000, a completely different conclusion would have been reached, primarily that there was no direct effect of plant density, irrigation regimes or the combinations on greenbug density. Now we know, with three years' data, that natural rainfall plays an important part in determining irrigation effects.

D. Publications:

Michels, G. J. Jr., G. M. Piccinni, C. M. Rush, and D. A. Fritts. 1999. Sensing Greenbug (Homoptera: Aphididae) Infestations in Winter Wheat with Infrared Transducers. Southwest. Entomol. 24:269-279.

Michels, G. J., Jr., C. M. Rush, G. M. Piccinni, and D. A. Owings. Impact of plant populations and irrigation regimes on greenbug densities in grain sorghum. Southwest. Entomol. To be submitted in February 2001.

Michels, G. J., Jr., C. M. Rush, G. Piccinni, and T. H. Marek. Using multispectral radiometers for greenbug detection in wheat. Journal undecided. In prep.

Piccinni, G., C. M. Rush, G. J. Michels, Jr., and J. K. Burk. An automated remote sensing platform for insect and disease detection. Phytopathology. In prep.

E. Precision agriculture proposals:

Michels, G. J. Jr., and D. A. Fritts. 2000. Assessment of Multi-Spectral Radiometers for Remote Sensing of Greenbug Infestations in Winter Wheat. Texas Wheat Producers Board. Funded, $9,000.

Michels, G. J. Jr., C. D. Patrick, and T. H. Marek. 2000. Modeling and Control of Western Corn Rootworm Populations in Field Corn. Texas Corn Producers Board. Non funded, $9,500.

Michels, G. J. Jr. 2001. Modeling and Control of Western Corn Rootworm Populations in Field Corn. Texas Corn Producers Board. Pending, $9,500.

Waits, D. A., F. R. Schiebe, N. C. Elliott, G. J. Michels, Jr., K. L. Giles, T. A. Royer, M. Daggy. 2000. Remote Sensing to Detect Greenbug Infestations on Wheat. 2000. USDA SBIR. Pending, $65,000. As a note to this proposal, my program has entered into a cooperative agreement with Mr. David Waits, USDA ARS, and Oklahoma State University to provide expertise for the proposed research by SST Development Group, Inc., which is owned by Mr. Waits. No direct funds will come to TAES through this grant, however, there is a great potential for future collaboration in research that will produce funding.

F. Precision Agriculture meetings attended/papers (posters) presented:

Michels, G. J., Jr., G. Piccinni, C. M. Rush, and D. A. Fritts. 2000. Using infrared transducers to sense greenbug infestations in winter wheat. Fifth International Conf. on Precision Agri. Bloomington, Minnesota.

G. Other developments:

With the techniques we have developed over the last three years, we are interested in expanding our ability to remotely sense other agronomic stresses. A separate part of our research program is biological control of weeds with insects. We have begun a separate pilot study to determine if musk thistle, a rapidly-growing problem in the high plains, can be remotely sensed satellite or aircraft-borne imaging, and if the progression of biological control can be verified through these images. These technologies may also be used to map and track other noxious weed biological control programs in Texas and other states.

The future plans of the Precision Agriculture group, to jointly fund a remote sensing platform that is under our control is very exciting. Although we have made good strides in determining the beneficial use of IRT's and multispectral radiometers in greenhouse experiments over the last three years, field-truthing these experiments has been a problem because we did not have the tools to carry out the research in a consistent manner. Commercial companies (both satellite and aircraft) have proven to be very unreliable. The only concern for future research is the distillation of the enormous amount of data that precision agriculture experiment tend to produce.